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STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
STATE GEOLOGICAL SURVEY DIVISION

Morris M. Leighton, Chief

MACOMB AREA

Macomb and Colchester Quadrangles

Illinois Academy of Science

GEOLOGICAL GUIDE LEAFLET NO. 53

Gilbert O. Raasch
Urbana, Illinois
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PART I - ITINERARY

0.0	0.0	Leave campus at Adams and Ward Streets. Turn right (W) on Adams.
0.5	0.5	Intersection; continue ahead (W)
0.4	0.9	STOP NO. 1. Park along roadside.

The melting of the glaciers of the Pleistocene (Ice Age) left a thick blanket of mixed earth and stone over most of the Illinois landscape, effectively concealing the surface of the bedrock.

The last glacier to invade this portion of Illinois (the Illinoian glacier) left a remarkably flat plain of glacial debris, called a "till plain." It is the surface of this plain which makes the flat horizon of the upland beyond the LaMoine River valley in the foreground. The valley itself has a subdued contour of rounded topography with controlled, vegetated slopes, suggesting it was formed not long after the melting of the ice, over 150,000 years ago. An inner valley, close to the present stream, has steeper, more freshly cut walls, and many of the tributaries which we will cross in the next few miles are youthful, with V-shaped contour and actively eroding slopes.

0.0	0.9	Continue ahead (W).
1.4	2.3	Note terrace level on left, below which LaMoine River has entrenched some 30 feet.
0.1	2.4	Cross LaMoine River.
0.2	2.6	Junction. Bear right with main road ascending hill.
0.6	3.2	STOP NO. 2. Park along roadside at gully. At the top of the gully section, the few feet of earth forming a relatively steep slope is a loess deposit of Peorian age. Below this is a humic zone representing a soil development of the Sangamon interglacial stage. The rest of the cut consists of glacial till of Illinoian age, which is oxidized to a yellowish shade in its upper portion and leached of its lime; downward the buff grades to gray where the till has not yet been appreciably altered by the descending surface waters.

All of these deposits are related to events in the Pleistocene, or "Ice Age" representing roughly the last million years of geologic time. During the "Ice Age", continental glaciers were present in temperate North America for only a minority of the time. Four times major ice invasions moved down from northern Canada, while between these invasions there existed mild intervals measurable in hundreds of thousands of years.

When the glaciers retreated, the earth and stone they carried with them was dropped as an unsorted blanket of material we call glacial till. During the long mild intervals, surface waters descending into the earth dissolved the lime in the upper part of the till blanket, oxidized the iron present to ocher or red shades, and in the most extreme case reduced the silica to a pastey gel, called a "gumbotil." The vegetation which flourished during the interglacial periods developed dark humic soils. During periods of glacial advance and retreat, great

rivers like the Mississippi and Illinois carried vast torrents of water during the summer season, but were reduced to broad sand and mud flats during the cooler seasons. The prevailing westerly winds picked up the sand and dust, depositing the latter as "loess" over the lee uplands.

The present cut thus reveals the following events:

1. Third, or Illinoian, glaciation of this area, with deposition of the Illinoian glacial till.
2. Third, or Sangamon, interglacial interval of mild climate, during which upper part of the glacial till was altered by descending surface waters, and during which a soil zone developed.
3. Return of glacial climate, during which glacier did not advance as far as this area; streams carrying melt waters were a source of the "loess", which originally covered all of the upland area of this region.

0.0 3.2 Continue ahead (N)

0.3 3.5 Junction; Turn left (W) with main road.

0.3 3.8 STOP NO. 3. Park along roadside, short of bridge over Spring Creek.

At the top of the deep cut can be seen about 10 feet of Illinoian glacial till, which is a lateral continuation of the deposit seen at Stop No. 2. Here, at a lower elevation, we can observe, below the till, about 35 feet of stratified sand and silt deposited at some time during the Yarmouth interglacial interval which separated the Illinoian glacial period from the earlier, Kansan glacial period.

When water contacts glacial till, the effect is one of sorting, as the clay is commonly carried long distances downstream, and the sand and pebbles are dropped closer to the source.

In the present instance, the sand and silt was most likely deposited in a fairly large stream valley during the retreat of the Kansan glacier. There is a possibility, however, that it was laid down ahead of the advancing Illinoian glacier.

0.0 3.8 Continue ahead. Crossing Spring Creek, we ascend to the flat upland of the Illinoian Till Plain, which is trenched by youthful, V-shaped valleys, undergoing active erosion.

1.8 5.6 Intersection; continue ahead (W).

0.5 6.1 Junction; turn left (S) and descend into hollow. Here Pleistocene deposits can be seen overlying bedrock of Pennsylvanian ("coal period") age.

0.7 6.8 STOP NO. 4. Along roadside, short of junction. Walk south along abandoned road, 1/8 mile to creek valley.

A slight doming of the strata along the creek brings the Colchester coal bed above the surface. This coal seam, also called the Illinois Coal No. 2, ranges in thickness from two to two

and one half feet thick, and was the basis of a thriving coal mining industry here in the past.

The coal is overlain by the Francis Creek shale, which in places along the creek contains carbonized algal remains, and locally shows incipient concretionary development.

Equally interesting is the great variety of boulders, washed out of the overlying glacial deposits and now lying in the bed of creek, the waters of which carried off the finer constituents of the glacial till in the course of the cutting of the valley. Many of the boulders are of rock types which do not outcrop within many hundreds, of this region. Among these are such ancient Pre-Cambrian igneous and meta morphic rocks as granite, greenstone, and quartzite.

Large masses of conglomerate, cemented by iron oxide and consisting chiefly of rounded and polished pebbles of brown chert are also common. These are remnants of a local deposit of pre-glacial stream gravels, patches of which may still be found between the glacial till above and the Pennsylvanian ("coal period") bedrock shale below. The gravel is thought to have been deposited during the Tertiary period, not long before the coming of the ice.

0.0 6.4 Turn right (W) onto minor road. (Avoid in wet weather.)

1.2 7.6 Intersection. Turn left (S) at Martin School.

0.6 8.2 Argyle Church intersection; continue ahead (S).

0.5 8.7 Intersection; continue ahead (S).

0.5 9.2 Turn left (E) with main road at Ragtown School.

0.5 9.7 Turn right (S) with main road and descend grade. Clay pit on right in Pennsylvanian shales.

0.2 9.9 LaMoine River; massive ledges of basal Pennsylvanian sandstone exposed in river bank.

0.5 10.4 Turn left off highway, into brick plant.

<u>STOP NO. 5.</u> Colchester Brick and Tile Company pit and plant.

The clay pit east of the plant shows the following succession of Pennsylvanian strata, beginning at top.

Carbondale Group	
Francis Creek Shale, gray	15'0"
Colchester (No. 2)	2'4"
Under clay, white, calcareous	4'0"
Tradewater Group	
Shale, drab, sandy; contains a few flat concretions of ferruginous, sandy limestone in lower half	8'0"
Shale, blue and yellow, sandy at top	12'0"
Shale, white, has carbonaceous streaks near base	5'0"

Sandstone, argillaceous, compact	1'0"
Potters clay, gray to blue; has carbonaceous streaks near top.	10'0"
Sandstone, yellowish to bright red, thin-bedded.	5'0"

Practically all of the beds in the above section (which is quoted from Hinds' Colchester-Macomb Folio), except the coal and some of the sandstone, is usable for the manufacture of structural clay products. The potters clay burns to a light cream color, whereas admixture of some of the higher shales results in various red shades of brick and tile. A great asset to operations at this place is the virtual lack of any over burden above the productive formations; even the covering of loess at the top of the cut can be used for some ceramic purposes.

0.0 10.4 Leave brick plant and turn left (S) onto public road into COLCHESTER.

0.7 11.1 Stop Sign. Turn right (W) onto Route 136 in Colchester.

0.5 11.6 Turn right onto blacktop road just outside of Colchester. Note gob piles of old mines in the Colchester coal seam.

1.3 12.9 Descend grade to LaMoine River (East Fork).

0.4 13.3 Cross LaMoine River and turn right on minor road to stone quarry.

0.5 13.8 STOP NO. 6. In parking area of abandoned quarry. Go north across creek to abandoned limestone quarry.

The sandstone seen along the LaMoine River north Colchester (and at the top of this quarry) is the basal deposit of the Pennsylvanian system. Below it here we see some 30 feet of limestone belonging to the older, Mississippian system.

In the quarry entrance about 8 feet of dull, brown magnesian limestone belonging to the Salem Formation is exposed. The quarry itself is in gray, dense limestone (and limestone conglomerate and braccia) belonging to the St. Louis Formation. The St. Louis limestone was once much thicker here, and was doubtless overlain by still later formations also belonging to the Mississippian system and still present farther south in Illinois.

Following the deposition of these formations in the Mississippian sea, a moderate uplift of the land surface took place. As always under these circumstances, the forces of weathering and erosion set to work to strip the land surface down close to the level of the sea (base level). Erosion continued until events in eastern United States caused great quantities of sand and mud to be washed from high mountain ranges rising there and carried westward across the eroded plains. This brought about the beginning of deposition of Pennsylvanian sediments in the region.

The upper part of the St. Louis limestone in the quarry is much broken, a result of the erosive action which preceded Pennsylvanian deposition here. The lower 1 to 10 feet of the limestone in the quarry is also much fractured, but recemented to conglomerates and breccias. The conglomerate has rounded pebbles, and seems to have been the result of wave action in the St. Louis sea. The breccias for the most part

lie above the conglomerate and may have been caused by a shattering of the rock during compaction and settling of the limestone over and into the irregular masses of conglomerate and associated blue-gray shale.

The limestone yields valuable resources of roadstone and of agstone for sweetening the soil. Illinois uses more agstone than any other state.

STOP NO. 6A. Above the quarry rock, some 70 feet of Pennsylvanian strata have been stripped away to reach the limestone. The Pennsylvanian succession of strata, from top down, was roughly measured as follows:

Sandstone, silty, in thin, wavy layers.	10 feet
Shale, gray.	6 feet
Limestone, conglomeratic, hard, dense, gray to brown, in discontinuous nodular masses.	1.5 feet
Shale.	6-8 feet
Sandstone, rusty; single layer.	1 foot
Shale, subfissile, dark gray.	18-20 feet
Coaly shale streak.	3 inches
Clay ("potters clay"), light gray, non-bedded.	7-8 feet
Coal, rather impure, shaly	24-30 inches
Under clay of varied thickness, compensating underlying sandstone.	--
Sandstone, highly ferruginous, full of bright ocher iron-oxide and plates of gypsum (selenite). Passes laterally to clay full of strap-like plant stems.	3-5 feet
Surface of St.Louis Limestone.	

The great variety of rocks represented among the strata of this Pennsylvanian section reflects the range of environments existing at the time. Great rivers flowing westward from the rising mountains of the East across the low plains to a western ocean, deposited sands in their channels, and fresh water muds over their flood plains in high water stages. The plains area, of which Illinois was a part, at this time seems to have been slowly sinking, evidently at an irregular rate. Thus at times, vast fresh water swamps, comparable to those of the Amazon basin, covered the low country. Dense jungle vegetation accumulated here in peat-like masses, and gave rise to the coal seams so important to our present economy. As sinking progressed, for brief periods the western ocean expanded from Kansas and Texas to Illinois, and caused the deposition here of limestones and shales in which the remains of marine animals may still be found. This alternation of floodplain, swamp, and sea was repeated many times, as the coal bearing formations of Illinois slowly accumulated. The repetition of similar successions of strata of different types gave rise to stratigraphic cycles, called cyclothems (see example in Supplement).

0.0 13.8 Reverse route and turn right (W) onto highway, and ascend grade.

0.6 14.4 To right is a birdseye view of the quarry just visited and of the working quarry which lies north of it. In distance, near top of bluff on opposite side of valley can be seen an old coal mine in the Colchester (No. 2) Coal horizon.

0.3	14.7	Road turns left (W).
0.3	15.0	Junction; turn right (N).
1.1	16.1	Junction; turn right (E).
1.6	17.7	Intersection; turn right (S) at "Argyle Lake" sign, and follow main gravel road to Argyle Lake State Park.
0.8	18.5	Turn left (N) into State Park.
0.6	19.1	Junction; turn right to "Picnic Area."
0.2	19.3	LUNCH STOP on Lake Argyle.
0.0	19.3	Retrace route to highway and turn right (W).
0.3	19.6	Road turns right (N).
0.6	20.2	Intersection. Turn left (W) at "Argyle Lake" sign.
1.6	21.8	Junction; turn left (S).
1.1	22.9	Junction; continue ahead (S).
1.1	24.0	Cross LaMoine River (East Fork).
1.6	25.6	Stop Sign. Turn right (W) onto Route No. 136 in TENNESSEE.
2.6	28.2	Highway junction. Turn left (S) on Route No. 61.
1.4	29.6	Cross "Rattlesnake Den" a rocky glen cut in basal Pennsylvanian sandstone, which is here unusually thick.
2.3	31.9	Refinery on right.
0.7	32.6	Enter COLMAR.
1.0	33.6	Road curves left and right across overpass.
0.3	33.9	Cross LaMoine River.
0.8	34.7	STOP NO. 7. Park along shoulder. (Remain in cars).

We are parked among pumping oil wells, gathering lines, and gathering tanks of the Plymouth-Colmar oil field. The first commercial oil well in thie field was completed on April 30, 1914, on the J. Hoing farm, in the SW.1/4 of NW.1/4, sec. 16, T. 4N., R. 4W., less than 2 miles northeast of this point. It initially flowed at the rate of 40 barrels per day.

In spite of the early discovery, the field still has some 200 producing wells which last year yielded a total production of 78,000 barrels of petroleum. All of these secure their oil from the Hoing Sand, between 400 and 515 feet below the surface. The oil is of high gravity (37°), green in color, and non-acid ("sweet").

0.0 34.7 Continue ahead (S).

1.9 36.6 Turn right (W) with Highway 61.

0.6 37.2 Enter PLYMOUTH.

0.3 37.5 Highway turns left; continue ahead (W) across railroad track in Plymouth.

0.3 37.8 Go right (N) at town square.

0.5 38.3 Intersection. Turn left (W).

0.5 38.8 Road turns right (N).

0.2 39.0 Go diagonally left (NW) at Uncle Sam mail box.

1.0 40.0 Roadcut and old quarry in Keokuk limestone. Continue ahead (N) across Bronson Creek.

0.5 40.5 STOP NO. 8. Park along roadside.

Quarry is in rather thin-bedded layers of the Keokuk limestone of Mississippian age. The exposed Mississippian formations in the Macomb area are, from top down, as follows:

St. Louis Limestone	30 feet, maximum
Salem Limestone, sandy at top	80 feet
Warsaw Shale and Limestone	
Keokuk Limestone	100 feet, plus

The Keokuk limestone is highly fossiliferous; bryozoa, brachiopods, crinoids, and cup coral especially common; trilobite heads and tail and fish teeth are less numerous (see supplementary plates).

0.0 40.5 Continue ahead (N).

0.9 41.4 Intersection; turn left (W).

1.0 42.4 Junction; turn left (S).

0.4 42.8 Cross Bronson Creek.

0.5 43.3 Junction; turn right (W).

0.8 44.1 Cross Panther Creek and turn right (W) at Junction.

0.2 44.3 STOP NO. 9. Park along roadside.

The creek on the left side of the road flows over shales and impure limestones of the Mississippian, Warsaw Formation. The Warsaw Formation is famous for its geodes, which weather out of the shale as rough-surface balls, that, on fracture, are revealed to be shells of chalcedony, lined or filled with crystals of quartz, or with gray to brown chalcedony. Many other minerals have been found in the interior of the Warsaw geodes, most notably calcite, dolomite, pyrite, marcasite, Kaolinite, aragonite, barite, chalcopyrite, and numerous secondary minerals.

Much remains to be learned concerning geodes, and their method of origin remains a matter of some controversy.

0.0	44.3	Continue ahead, ascending grade past outcrops of Salem and St. Louis Limestone. At the top of the hill, about 4 feet of St. Louis limestone, with wavy lamination suggesting algal origin, rests on dolomitic Salem limestone and is overlain by basal Pennsylvanian sandstone.
0.0	44.3	Continue ahead (W) across intersection.
0.9	45.2	Jog left and right, and continue west.
0.2	45.4	Turn left (S).
0.6	46.0	Road turns right (W) in hollow, and passes schoolhouse. (Providence School)
0.2	46.2	Road turns left (S) and crosses creek. Outcrop of St. Louis limestone.
0.3	46.5	Road turns right (W).
0.3	46.8	Road turns left (S).
0.8	47.6	STOP. Junction with Plymouth-Denver road. Turn left (E), toward Plymouth.
0.7	48.3	Bridge over Panther Creek. Quarry on right is in St. Louis limestone, overlain by basal Pennsylvanian sandstone.
4.6	52.9	Plymouth town square.

END OF CONFERENCE - Auf wiedersehen!

ALTERNATIVE AFTERNOON TRIP

For those particularily interested in geode collecting, the following alternative is suggested:

Leave Lunch Stop and drive south into Colchester.

Go west from Colchester on Route No. 136 to Hamilton (32 miles).

In Hamilton, turn left (S) onto Route No. 96. Go south 2 miles and west 1 mil e on Route 96.

At intersection in hollow turn right (N) on minor road, and park.

This is Crystal Glen, which flows through Warsaw Shale rich in geodes, which may be seen in place in the bluffs, and loose in great numbers in the bed of the creek. The creek here is flowing over highly fossiliferous Keokuk limestone.

Gravel pits at the northwest and southeast corners of the intersection are in the polished gravels of pre-glacial, Tertiary age (Lafayette). In addition to the chert and quartz, the gravels include agate and taconite from the Lake Superior Region, petrified wood from the Cretaceous of the Great Plains, and fossils from Ordovician, Silurian, and Devonian formations of the Upper Mississippi Valley. This variety of material from diverse and distant places suggests a major river system was instrumental in the transportation and deposition of the gravels.

Above the Tertiary gravel is glacial till deposited by the Illinoian ice sheet and showing excellent gumbotil development in its upper portion.

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GEOLOGICAL HISTORY OF MACOMB AREA

The geological story of the Macomb region falls naturally into four great chapters:

1. The formation and beveling of the crystalline basement.
2. The formation of the bedrock layers.
3. The "lost interval" of erosion.
4. The Ice Age history.

1. The crystalline or "granite" basement on which the bedrock layers were laid down comes to the surface in the St. Francis Mountains of Missouri and in the region surrounding Lake Superior. In Illinois only a half dozen wells have penetrated to "the granite."

Some of the basement rocks were once sandstone or shale--others cooled from a molten state as they poured out upon the surface as lava, or deep underground under great pressure. These ancient rock masses then were twisted and shattered in great mountain-making movements that had their roots deep in the earth's crust. Finally, erosion working through an immense span of geologic time, wore the mountains down to a nearly flat plain.

The formation of the basement foundation consumed three-fourths of all geological time, during the two eras (Archaeozoic and Proterozoic) classed together as "Pre-Cambrian."

2. The Cambrian sea was the first to bring preservable types of life to the region, and marks the beginning of a long period of time (the Paleozoic Era) when Illinois was beneath the waters of seas that invaded the continent's interior. It was during this era that the layers of bedrock limestone, shale, and sandstone were laid down as sediment on the bottom of the sea. Late in the Paleozoic Era, during the Pennsylvanian Period, layers of coal were formed, presumably in great swamps close to sea level. The coal-bearing strata once extended across the entire region, but were partially worn away during the long period of erosion that marks the "lost interval" in Illinois.

3. After the Coal Period, over 200 million years ago, the seas withdrew and there is no evidence that they again covered this part of Illinois. Instead, the region was raised a moderate distance above sea level, and streams and weathering agencies set to work to strip away the rocks, layer by layer. The debris of this erosion process was carried off to lower regions to be deposited as new sediments that would some day harden into rock strata. Thus through the days of the dinosaurs and of all the strange and primitive mammals that followed them onto the scene, we have no record of the nature of life here in Illinois. We only know that erosion laid bare the Mississippian limestones and shale that once were burried beneath the coal strata, and that streams cut deep valleys into the bedrock.

4. About a million years ago, climatic conditions permitted the accumulation of great ice masses at the poles and caused them to move as continental glaciers down into our present temperate zone. Climate during the ice age fluctuated so that mild intervals of hundreds of years in duration intervened between stages of glacial advance.

Thus we can divide the Pleistocene, or Ice Age, according to four major glacial advances, the Nebraskan, Kansan, Illinoian, and Wisconsin glacial stages. Of these only the middle two are known to have crossed the region as presumably did also the first or Nebraskan Glacier. The last or Wisconsin glaciation did not extend this far southeast, but the waters from its melting seriously effected the Mississippi River which indirectly contributed the loess that is so vital a factor in the fertility of our uplands.

SUGGESTED REFERENCES

Horberg, Leland, "Bedrock Topography of Illinois," Ill. Geol. Surv., Bull. 73.

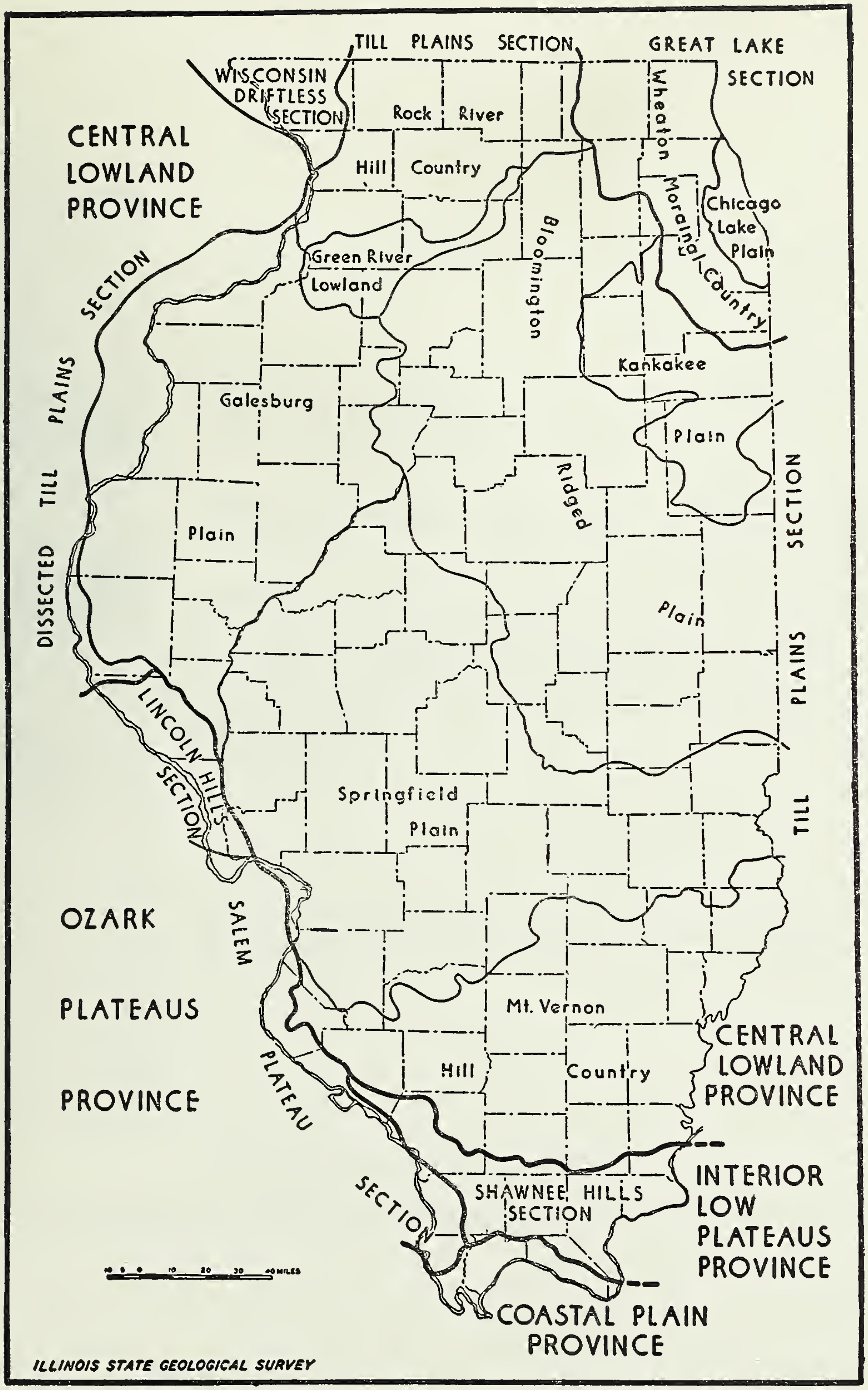
U.S. Geological Survey; Folio No. 208, "Colchester-Macomb Folio," Henry Hinds, 1919.

GENERALIZED GEOLOGIC COLUMN
FOR THE MACOMB AREA
Prepared by the Illinois State Geological Survey

ERAS		PERIODS	EPOCHS	FORMATIONS
Cenozoic	Recent Life	Quaternary	Pleistocene	Recent Post-glacial stage. Wisconsin glacial stage. Sangamon interglacial stage. Illinoian glacial stage. Yarmouth interglacial stage. Kansan glacial stage. Aftonian interglacial stage. Nebraskan glacial stage.
		Tertiary	Pliocene Miocene Oligocene Eocene Paleocene	"Lafayette" stream gravels.
Mesozoic	Middle Life	Cretaceous		Present in extreme southern Illinois only.
		Jurassic		Not present in Illinois.
		Triassic		Not present in Illinois.
Paleozoic	Ancient Life	Permian		Not present in Illinois.
		Pennsylvanian		Carbondale & Tradewater groups: Sandstones, silstones, shales, clays, & coal beds.
		Mississippian	Upper	Not present in Macomb area.
			Lower	St. Louis Limestone. Salem Limestone & Dolomite. Warsaw Shale & Limestone. Keokuk Limestone.
		Devonian		Limestone and sandstone in deep wells.
		Silurian		Not present in Macomb area.
		Ordovician		Shales, limestone, and sandstones, in deep wells.
		Cambrian		Dolomites in deep wells.

Proterozoic
Archeozoic

$\Big\}$ Referred to as "Pre-Cambrian" time.



PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

(Reprinted from Report of Investigations No. 129, Physiographic Divisions of Illinois, by M. M. Leighton, George E. Ekblaw, and Leland Horberg)

7 (50818)

10 Shale, gray, sandy at top; contains marine fossils and ironstone concretions especially in lower part.

9 Limestone; contains marine fossils.

8 Shale, black, hard, laminated; contains large spheroidal concretions ("Niggerheads") and marine fossils.

7 Limestone; contains marine fossils.

6 Shale, gray; pyritic nodules and ironstone concretions common at base; plant fossils locally common at base; marine fossils rare.

5 Coal; locally contains clay or shale partings.

4 Underclay, mostly medium to light gray except dark gray at top; upper part noncalcareous, lower part calcareous.

3 Limestone, argillaceous; occurs in nodules or discontinuous beds; usually nonfossiliferous.

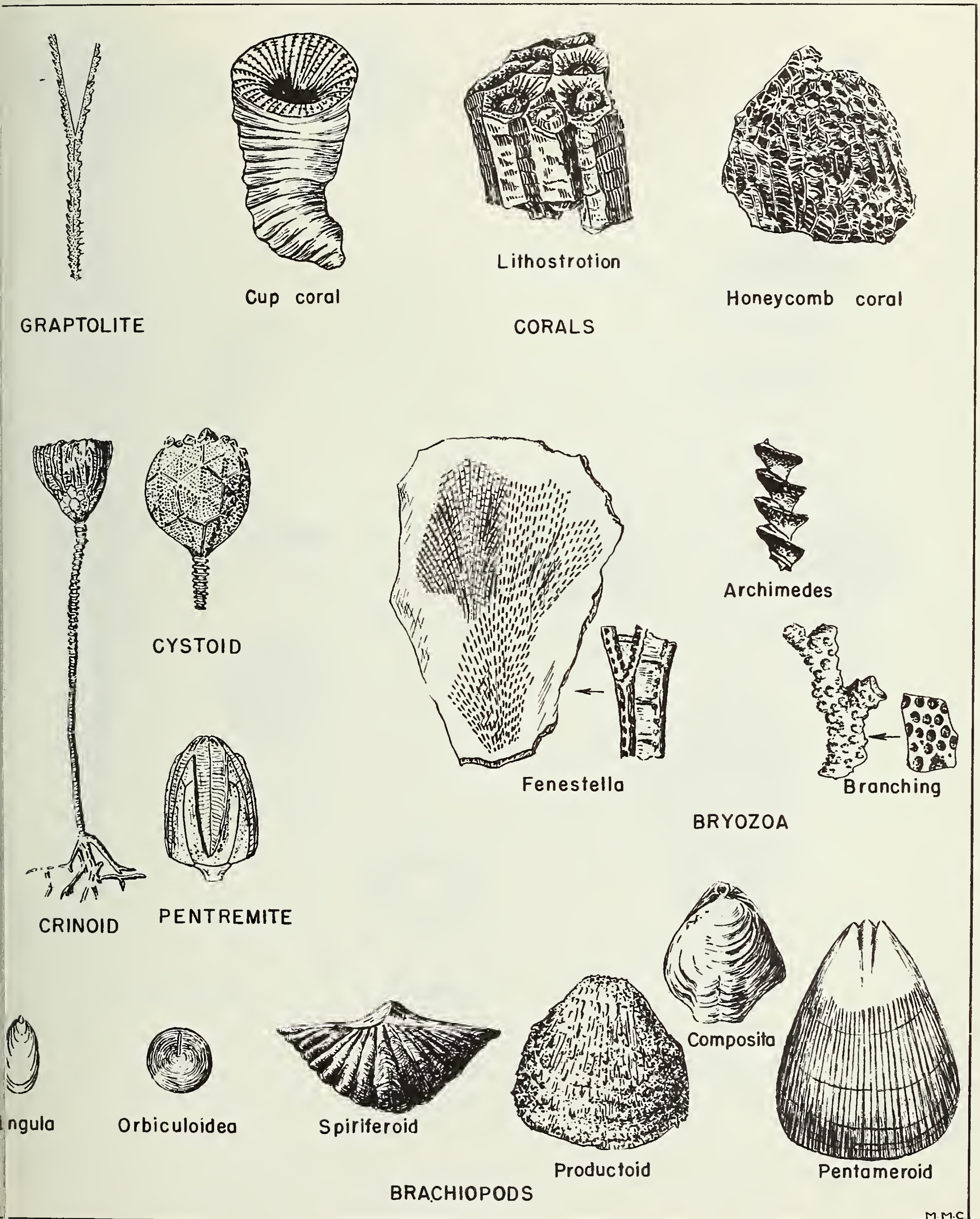
2 Shale, gray, sandy.

1 Sandstone, fine-grained, micaceous, and siltstone, argillaceous; variable from massive to thin-bedded; usually with an uneven lower surface.

AN IDEALLY COMPLETE CYCLOTHEM

(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)

COMMON TYPES of ILLINOIS FOSSILS



COMMON TYPES of ILLINOIS FOSSILS